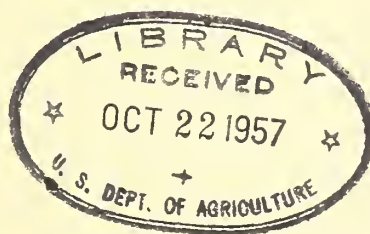


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MECHANIZATION
OF TRAIL MAINTENANCE
AND TRAVEL
COORDINATED ACTIVITIES,
Regions 1,3,4,5, and 6
(T.E.B. No. 513)



COMPILED BY
H. K. HARRIS, FORESTER, REGION 1
U.S. DEPARTMENT OF AGRICULTURE
U. S. FOREST SERVICE
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MECHANIZATION OF TRAIL MAINTENANCE AND TRAVEL
COORDINATED ACTIVITIES
Regions 1, 3, 4, 5 and 6

INTRODUCTION

This report records progress and developments of a program to mechanize trail maintenance and travel. It covers a period of approximately 6 months. Regions 1, 4, 5 and 6 have been actively engaged in a coordinated effort since 1955. Region 3 has recently enlisted in the program and sent representatives to the last meeting of coordinators held in San Francisco, February 18 and 19, 1957.

THE MECHANIZATION PROGRAM

Mechanization means different things to different people. Usually the first thought is "machines to increase production." Machines are important in this day and age, but they are only one necessary part of a program to improve trail conditions.

The mechanization program includes:

1. The test and selection of commercially available equipment which has, or may have, application to the trail maintenance and construction job and will result in an economical increase in production per man hour.
2. The development, test and manufacture of necessary equipment which is not presently available from commercial sources. The modification when necessary of commercially available equipment to better adapt it to our requirements.
3. The development, test and revision as necessary of new methods and procedures. Includes operational use of selected and approved machines.
4. Advance planning and development of planning methods for a modern mechanized trail system; correlation with modernized transportation planning.
5. The application of new operational plans including adequate supervision, thorough training of personnel, priority selection of trails for mechanization, financing and purchase of equipment.
6. The report of progress, developments and proven equipment and methods for all-Service benefit. A continual exchange of information among cooperating regions and through a project coordinator to avoid duplicated effort and expense and provide satisfactory progress.

HISTORY

Work Improvement Suggestion No. 529, December 16, 1948.

Memorandum O - STUDIES - Work Improvement No. 237

E - EQUIPMENT & MATERIALS - Experimental of April 26, 1950.

T.E.B. No. 326 approved and financed jointly by Engineering Region 1 and Washington office F. Y. 1954.

Interim report published by Region 1 Engineering, January 1955. 1/

Proposal for coordinated program by representatives Regions 1, 4, 5, 6 and Washington office, May 2-4, 1955. 2/

First meeting of coordinators, Regions 1, 4, 5, 6 and Washington office, June 15-16, 1955 at Missoula, Montana. Action Plan prepared. 3/

Second meeting of coordinators, June 12-13, 1956 at Portland, Oregon. Action Plan revised July 1956. 4/

Progress Report - Coordination Activities, September 1956. 5/

Project Equipment Notes - series started September 1956. 6/ Includes investigations by regions on selected equipment items.

1/ E-ROADS & TRAILS-General, Development Report T.E.B. No. 326, January 17, 1955 compiled by R. J. Henderson and A. E. Allen.

2/ "Report of Meeting on Mechanical Trail Maintenance," May 2, 3, 4, 1955 by L. H. LaFaver (with Resume of Field Demonstrations, May 3, 1955).

3/ "Action Plan for Interregional Coordination of Mechanization of Trail Maintenance and Travel Project, T.E.B. No. 326" (out-of-print).

4/ "Action Plan for Interregional Coordination - Mechanization of Trail Maintenance and Travel Project - T.E.B. No. 513." Available from W. O.

5/ "Progress Report - Coordinated Activities - Mechanization of Trail Maintenance and Travel, T.E.B. No. 513" compiled by H. K. Harris September 1956.

6/ Project Equipment Notes - T.E.B. No. 513. Available by writing Washington office or regional forester, Missoula, Montana.

Report by Region 1 in third year of the Mechanized Trail Maintenance and Travel Study T.E.B. No. 326, January 1957. 1/

Region 3 requests permission to send representation and to enlist in the Cooperative Effort January 1957 Third Meeting of Coordinators February 18, 19, 1957 at San Francisco, California.

Report on Trail Scooter Developments, Missoula Equipment Development Center, ready for publication March 1957.

Report on Powered Carrier Development, Missoula Equipment Development Center, ready for publication March 1957.

COORDINATION OBJECTIVES

1. Urge immediate action by participating regions and the field to make use of machines, camp equipment and new methods presently available and which have possibilities in increasing production and reducing costs.
2. Accelerate mechanization of trail maintenance and travel through broader contact with commercial markets, intensified search for usable equipment and ideas, and operational testing under widely diversified field conditions of new equipment and methods.
3. Provide experience needed to formulate new trail standards or necessary modification and planning guides needed to meet mechanized requirements, and develop basis for replanning work. Development and test new operational methods including supervision and training.
4. Encourage cooperative commercial development or improvement to present equipment by coordinated information on design requirements, mechanical failures, accessory needs, anticipated quantity purchases and standard or comparable purchase specifications.
5. Develop uniform measure of cost and production for future comparison of new methods or equipment.
6. Report and record accurately the findings, with standardized cost estimates, for benefit of other interested regions.

1/ "Equipment Development Report - T.E.B. No. 326, Mechanization of Trail Maintenance and Travel," compiled by R. J. Henderson and M. J. Boesch, available from regional forester, Missoula, Montana.

CONSIDERATIONS

It was recognized that basic and uniform considerations should be established for development of the action plan and as general guidelines for individual effort. The following considerations were established by group meeting of coordinators June 15 and 16, 1955, reviewed and improved at the coordinators meeting June 12 and 13, 1956, and approved for further action planning at the coordinators meeting February 18 and 19, 1957.

1. Machines and equipment will be made more dependable or otherwise improved through experience. There will be problems connected with the use of "Model-T" stage equipment. It is important that regional coordinators minimize the danger by basic training in the important considerations.
2. Cost analysis provides the only solid and uniform basis for comparison of one new method against another. A standard system of cost and production accounting is necessary to effective coordination, future development and uniform and accurate reporting. The system presently in use will be maintained.
3. Although new methods already developed and tested would undoubtedly do much to improve "mule or horse maintenance," it is agreed that comparisons of machines versus mules will buy little in future development. The comparison is therefore discontinued in order to simplify the problem.
4. New or modified trail standards and improved trail system planning guides will ultimately be necessary to greatest progress. Each region will search for and record information and suggestions for making future and necessary changes as uniform as possible from the Service standpoint.
5. Qualified supervision from the regional level is recognized as top priority at this stage of the development. Regions should provide adequate supervision for planning, inspection, training, reporting and development and field testing of new ideas and equipment. Properly and adequately supervised, this coordinated activity will stimulate early progress and accomplishment.
6. Commercial production of equipment will be encouraged. Regions will manufacture test machines and equipment only as necessary to determine specifications, design arrangements and cost estimates, or when the needed equipment cannot be obtained commercially. Whenever possible, consolidated orders for new equipment will be made to encourage commercial manufacturers to improve existing equipment and cooperate in new development work.
7. Suggested improvement of methods, subsistence and camp equipment or machines will be encouraged. Uniform cost accounting will provide basis for comparison of worth and will be obtained whenever possible as well as report information and photographs.

8. Accurate and thorough reporting is necessary. Regional coordinators will make every effort and take necessary steps to ensure that standard and uniform records and photographs are maintained on all field-test or development work.
9. A necessary part of the development is the search for new ideas and new equipment which may have application to the program. Procedures for current review and dissemination of interesting information should be considered in the orientation sessions. Properly handled by the regional coordinators (with information for the Service coordinator), this will make possible the purchase and test of new items or ideas without duplication of cost and effort. Clearance on unusual items must be secured from the Service coordinator to avoid duplication in the coordinated effort.
10. Based upon studies and the findings of T.E.B. project No. 326, the special powered carriers for transportation of personnel and equipment and trail graders, should be suited for travel or work on trails where the tread width does not exceed 18 inches.
11. Mechanization includes the use of dozers for trail maintenance and construction and the use of standard 4-wheel-drive equipment for travel. Careful consideration of all factors is necessary to determine areas and conditions. In general, dozers will be used to construct trails only in selected areas and where conditions are such that dozer construction is definitely the most economical method. Consideration must also be given to the control or regulation of any travel by 4-wheel-drive vehicles.
12. In general, the mechanization of trail maintenance and travel does not presume that machines will eliminate all need for horses and mules. Animals will always hold a necessary place in many areas and the results of mechanization will determine where and how reductions in pack stock may be safely made.

At the present time, we estimate that perhaps 50 percent of the trail mileage may be economically improved for powered carrier and scooter travel. Replanning and modernization of the trail systems along with transportation planning will be required to determine where mechanization will provide the most immediate financial returns and administrative benefits.

ORGANIZATION

The organization or coordinating group is composed of a representative from each participating region selected by the regional forester and called the regional coordinator; project supervisors (including field specialists) also selected by the regional forester; a Service coordinator selected at the interregional Engineering meeting held at Missoula; and a project advisor to represent the Chief's office.

The present organization consists of the following personnel:

Project Advisor	W. O.	Jim Usher	Engineering
Service Coordinator	R-1	Herb Harris	Fire Control
Regional Coordinator	R-1	Earl Angell	Engineering
Regional Coordinator	R-3	John Adams, Jr.	Engineering
Regional Coordinator	R-4	Jim Wise	Engineering
Regional Coordinator	R-5	Al Simpson	Engineering
Regional Coordinator	R-6	Elliott Roberts	Engineering

In addition to the regional coordinators it is urged that regional foresters of participating regions appoint a project supervisor and field specialists (see organization as developed in the Action Plan page 8 for T.E.B. No. 513). Experience has shown that these positions are necessary to greatest progress in this new field. Adequate training, supervision, and planning time is not available to the regional coordinators.

FIELD ACTIVITIES - RESULTS (July 1956 - February 1957)

The 1956 meeting of coordinators was held in June. It was decided that future meetings should be held early enough that any project proposals could be prepared in time for consideration by Technical Equipment Boards prior to the new fiscal year. Accordingly the 1957 meeting was held in February and this report of activities actually covers a period of approximately 6 months. Activities for a full calendar year will be reported following the 1958 meeting of coordinators.

ORGANIZATION AND ACTION PLANS

James M. Usher has been appointed project advisor and representative of the Chief's office.

H. K. Harris, service coordinator, is to attempt an adjustment of time requirements and if possible obtain help in the coordination activities thus permitting a larger proportion of time for direction of new approved development programs to be assigned the Missoula Equipment Development Center.

Robert J. Henderson has been transferred to regional office, Region 1, to act as field specialist in promotion, supervision, and training of field forces in mechanization of trail maintenance and travel. This operational program is to involve approximately \$30,000 per year for mechanization of 1,000 miles annually of selected trail. A proposed position of project supervisor (GS-11) to conduct transportation planning and general administration work has not yet been filled.

Region 3 has joined the cooperative effort. John A. Adams, Jr. will be the regional coordinator. Others will assist with the program development.

All regional coordinators are actively engaged in promoting mechanization by encouraging field participation and consideration, usually in selected test areas at this stage of the program. Region 6 leads the way with approximately 70 powered units, purchased from maintenance funds, in operational use. Other regions have from 6 to 15 units under test and observation or in regular maintenance operations.

The Action Plan, as revised at the Portland meeting June 12 and 13, 1956, is believed to be satisfactory without general revision. The elimination of the equipment section and substitution of a series of equipment notes for early dissemination of information received general approval. The Service coordinator has been requested to increase the original supply since not enough of the early notes have been available to meet requests in some regions. Insert sheets covering the new organization will be distributed for coordinators' copies only. New assignments for equipment testing, development and report will be included each year with the report of the annual meeting.

EQUIPMENT DEVELOPMENT AND OPERATIONAL TESTING

Powered Carrier Developments

The Missoula Equipment Development Center has completed the new F.S. model powered carrier which incorporates the best features of the commercial machines observed over three years of operations in four regions. This development was undertaken by request from Regions 4 and 5. An invitation for bids to manufacture operational test models has been issued. As soon as a price is indicated, regional coordinators will be informed and each cooperating region given an opportunity to participate in the consolidated purchase. It was brought out that at least two machines should be purchased for the following reasons:

1. Some defects are to be expected at this early stage of development and two machines are necessary for an accurate evaluation of their possibilities.
2. Further improvement will be made as a result of testing under the diversified conditions of operation.
3. Only by actual experience will the coordinators be qualified to make suggestions necessary to the final or best designs and arrangements.
4. The initial order will be sufficient to encourage manufacturers to continue to improve future models.

A report has been prepared for information of the field on the powered carrier developments. It will be available for distribution soon.

Region 6 has continued to work closely with Merry & Associates in improvements to the "Merry Packer." This commercially available machine has been giving very good performance in maintenance operations. A track unit, accessory equipment for the carrier, has been developed and is now undergoing operational testing and evaluation.

Region 6 has developed aluminum boxes for the Merry Packer to improve loading, handling, and convenience of field operations. This is an important development and will be covered in Project Equipment Note No. 16, March 1957.

The O'Neill carrier will be temporarily discontinued in the interest of standardization. It is hoped the company will continue to produce this machine for sportsman use. They have indicated they are interested in producing the improved F.S. model. If they are awarded a contract they will be required to comply with new specifications to ensure interchangeability of parts.

Region 4 has provided some cooperative assistance in the arrangement of a machine now under development at Boise, Idaho. Called the Nu-Way Packmobile; it incorporates a rubber track and appears to hold promise for specialized work.

Trail Scooters

The Missoula Equipment Development Center has continued a minor program to improve modified commercial machines for trail travel. Operational testing is being watched closely and work with commercial firms continued. At the meeting in San Francisco February 18 and 19, 1957, representatives of Cushman Motor Works in panel discussions indicated that some necessary modification might be accomplished on the assembly line if a combined order for 10 or more machines could be arranged. This proposal will be followed up and an invitation to bid on machines, for spring delivery, will be prepared. Cooperating regions will be notified of results and may participate in the initial purchase.

Trail scooters have not been used to a large extent in trail maintenance work to date. Test results and savings made on trails improved or suitable for scooter travel indicate considerable promise for future use. It is believed that scooter travel will sell itself to field crews at the proper time. Coordinators and others should proceed cautiously with a few units properly assigned and supervised. Meanwhile we must keep abreast of new developments and continue operational testing. Region 1 has made the greatest use of scooter travel for maintenance and are continually improving methods.

The stand-on lightweight scooter is undergoing operational and development testing. Commercial production has not been aggressively promoted although several firms have indicated interest when we have developed the final specifications. Some work in connection with the use of air wheels is indicated and will be continued.

Powered Graders

Region 6 continues to cooperate closely with Merry & Associates in operational testing and improvement of the powered grader. This machine is extremely important to mechanization of trail maintenance and travel and its use has demonstrated its practicability.

An accessory track arrangement to improve tractive ability has been developed and is now undergoing tests. Another accessory item; the powered winch for clearing operations is also being used successfully. In view of the acceptable performance of these machines for trail grading it is believed that new development of improved grading equipment should be considered in low priority when compared with other necessary developments.

Lightweight Camp Equipment and Special Rations

Some slow improvements are being made in the lightweight camp equipment and special rations. Region 1 will continue investigations, with information from other regions circulated as it is obtained. A limited supply of the 9-pound trail tent is available for trail maintenance outfits. They may be ordered through regional forester, Region 1, Missoula, Montana.

Rock Drilling Equipment and Methods

Although each cooperating region has been assigned some possible equipment for investigation, evaluation or test work, we have yet to come up with sound recommendations or the answer to which machines are best for mechanized trail maintenance. We have definitely determined limitations of several items of equipment, however.

Region 4 has tested possibilities for the use of shaped charges or demolition blocks. Coordinator Jim Wise reports that they do not have a practical application to mechanized trail maintenance work. The report has been reproduced in Project Equipment Note No. 15, January 1957.

Region 5 has completed comparative tests of an electric drilling outfit and two gasoline-powered hammer-drills. Results have been reported in Project Equipment Note No. 17, March 1957 for in-Service information only.

Region 1 has been using diamond drills in operational tests. These rotary core-drills are powered by a chain-saw motor. Operational tests show a cost of \$.86 per foot of drilled hole. A Project Equipment Note No. 18, April 1957 reports results.

Region 6 has arranged a powered carrier with air compressor, air-powered drilling tools, and other equipment for rock work on trails. Although this outfit is quite heavy it is a usable unit.

Region 6 has also eliminated one model of gasoline hammer from the competition; an in-Service report will be made.

PROJECT EQUIPMENT NOTES

Informal discussion and correspondence indicates that the Project Equipment Note Series is well received and that the Notes are given wide distribution. Approximately 20 Notes have been distributed, with additional subjects planned. The initial supply will be increased to include distribution in Region 3.

ASSIGNMENT OF RESPONSIBILITIES

The group recognizes the broad field of investigative and development work necessary. To avoid duplication of time and expense, assignments to investigate equipment or special methods for possible application to trail work have been made to each coordinator and region.

The group also recognizes the need for controlled and comparative testing with several kinds of equipment and with more than one unit of each kind. It is felt, however, that the broad field of equipment can be effectively narrowed by observational testing of selected equipment. Already the tests have demonstrated that some equipment is not well suited for the specialized requirements. We believe the cost of this investigative work to be less than test projects designed for maximum accuracy of results at this stage of the program. Usually the equipment purchased for test and observation will be used elsewhere in the region even though it may not be acceptable for our purposes. At a later time it may be desirable, in the interests of standardization, to conduct some carefully controlled tests of similar units to establish maximum performance and economy.

Region 1 will borrow (1957) drilling units already purchased by cooperating regions and believed to be the most practical to conduct some direct comparative tests of these models.

Regional coordinators will continue to inform the Service coordinator of new equipment believed to be suitable and obtain information on duplicate test assignments before purchasing units. This procedure is outlined in the Action Plan for the project.

C. Y. 1957 Assignments

<u>Region</u>	<u>Assignment</u>	<u>Remarks</u>
4	Test Syntron gasoline hammer for trail work.	Tests completed - report due.
5	Test and evaluate Homelite-Bosch electric drill outfit.	Completed - see Project Equipment Note No. 17.
4	Investigate and test shaped charges.	Completed - see Project Equipment Note No. 15.
5	Investigate possibilities of Homelite special mist blower for trail-side spraying.	Discontinued - equipment not now available.
6	Investigate applications for powered-winch accessory for Merry Grader.	Continuing - some work done but information for report not yet available.
6 & 1	Evaluate and test possibilities and arrangements for powered gravel carrier.	Continuing - R-1 trying special carrier; R-6 trying powered carrier.
5	Test and evaluate Pionjar BRH-50 Gasoline Hammer. Compare with Syntron RD-55.	Completed - See Project Equipment Note No. 17.
6	Evaluate compressor and air-drill unit for trail work.	Partially completed - continuing through summer.
1 & 6	Creek crossings for mechanized trails - methods, standards, improvements.	Continuing.
6	Two-speed arrangement for Merry Packer.	Completed - now available commercially.
4 & 1	Grading attachment for Lilienthal-Simpson carrier.	Discontinued - Lilienthal continuing commercial development.
5	Riding attachment for Lilienthal-Simpson carrier.	Completed - report due.
1	Stand-on scooter development.	Continuing - report completed; will be distributed.

<u>Region</u>	<u>Assignment</u>	<u>Remarks</u>
1	Commercial scooters - modifications.	Continuing - report completed; will be distributed.
6	Work with Merry on development of accessory items for packer and grader.	Continuing - commercially available accessory items now include track arrangement.
1	Design and test improved stove for mechanized crews.	Continuing - report due.
1	Continue investigations of special rations, dehydrated foods, etc.	Continuing.
6	Pionjar gasoline hammer-drill (heavy unit).	Test completed - report due.
1 & 5	Evaluation and use of small tractor with "Hula dozer". R-5 to cooperate with Arcadia Development Center.	
1	Development of gasoline-powered spray unit for use with all powered carriers.	Continuing.
1	Compare drilling equipment already available - borrow units from other coordinators.	
3	Evaluate Oliver OC-3 tractor with "Hula dozer" for possible use for special trails.	
1 & 4	Cooperate as necessary to complete training film on scooters and carriers.	1,100 feet taken - requires narration and prints.
6	Investigate possibilities of a training film on use of powered grader and winch attachment.	
4 & 1	Maintain contact and cooperate as necessary in commercial development of the Nu-Way Packmobile.	Continuing - demonstration held at Missoula in March.

GENERAL DISCUSSION

Meeting Date

It was agreed at the recent San Francisco meeting that an annual meeting of coordinators was desirable and that the 1958 meeting would be held at Ogden, Utah. The idea was advanced that the meeting should be delayed to provide an opportunity to hold a field demonstration in connection with the meeting. A meeting date in March would probably allow sufficient time to prepare any needed development proposals for T.E.B. consideration (these are due in the Washington office by April 15). It was agreed that the Service coordinator and advisor should establish a date for the next meeting with these considerations in mind.

